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Risks, Institutions and Common Pool Governance: The Case of Water Management in the Murray-Darling Basin[*]

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By definition, common pool resources are vulnerable to over-appropriation and destruction. It is this characteristic that has both intrigued and frustrated social scientists since Garrett Hardin wrote his seminal article on "The Tragedy of the Commons" in 1968.[1] It is also this characteristic that puts the users of common pools in a situation endemic with risk. Despite this reality, however, common pool analysts have not yet studied common pool governance from a risk management perspective. Accordingly, this paper looks at the historical governance of water in the Murray-Darling Basin using risk and risk management as central explanatory variables. This approach reinforces the important role of institutions in common pool governance and sheds new light on some of the theoretical problems currently being explored by common pool scholars.

Common Pools, Risks and Institutions

Like all freshwater resources, the Murray-Darling Basin can be conceptualized as a common pool resource characterized by the basic features of low excludability and high subtractibility. Low excludability refers to the difficulties involved in physically excluding potential users from the resource, through the use of fences or some other barriers, implying that it is likely to be shared among a large group of users. At the same time, high subtractibility refers to the finite nature of the resource and the reality that any water appropriated from the basin leaves less water available to other users.[2] The vulnerable nature of common pools and their susceptibility to destruction – the "tragedy of the commons" – is well known and need not be reviewed here. Nevertheless, it is important to conceptualize the Murray-Darling as a common pool in order to emphasize the interdependence of those who rely on the basin's water and the inherently finite nature of this resource.

Though the Murray-Darling qualifies as a common pool, its sheer size and political complexity makes it quite different from the relatively small common pools most normally studied. This resource stretches across 1,061,469 km^2 of southeastern Australia and traverses the territory of four Australian states (Queensland, New South Wales, Victoria and South Australia) as well as the Australian Capital Territory (ACT).[3] By transcending the borders of multiple sovereign jurisdictions (the states), the Murray-Darling is not just a common pool, but a *transboundary* common pool. Accordingly, the

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[*] This paper is a draft and should not be cited without the author's permission.
[1] Garrett Hardin, "Tragedy of the Commons," *Science* 162 (December 1968): 1243-49.
[2] Elinor Ostrom, Roy Gardner, and James Walker, *Rules, Games, & Common-Pool Resources* (Ann Arbor: University of Michigan Press, 1994) 6-8.
[3] Murray-Darling Basin Commission, "Basin Statistics," 2001, http://www.mdbc.gov.au/naturalresources/basin_stats/statistics.htm (2 December 2001).

governance of this resource involves a very large group of resource users dispersed over a wide geographic area and separated by political boundaries, but still interdependent in their reliance on Murray-Darling water.

Like all common pool users, water users in the Murray-Darling are engaged in a situation endemic with *risks*. These risks are related to the utility that humans attach to water and our dependence upon it in a multitude of varying socio-economic and ecological uses.[4] As a common pool resource, however, two types of risk are most common in human appropriations of water. The first type is related to the low excludability of common pools and the risks this creates for those who wish to secure *access* to the resource. Because common pools cannot be physically enclosed, there is always a risk that rivals may challenge for access to the resource, and those who rely on common pool appropriations must somehow deal with this risk in order to secure their appropriations. The second type of risk is related to the high subtractibility of common pools and the risks this creates for resource *supply*. All common pools have a finite carrying capacity[5] and those who appropriate from common pools always take the risk that the resource may become over-appropriated, reducing or destroying its availability. Risks of access and risks of supply are both very important to common pool users because they threaten the overall security that can be expected from common pool appropriations, and security is the overriding concern of common pool users in most situations.

Security can be regarded as the predictability or constancy that users can expect from their common pool appropriations. In the case of the Murray-Darling, security is about whether those who rely on Murray-Darling water can reasonably expect to receive the same level of water appropriations year after year. Security of appropriations is of fundamental importance because rational individuals will not invest their time, money and livelihood in activities that rely on common pool appropriations if they do not have a reasonable expectation of security. Furthermore, many of the economic and social activities that rely on common pool appropriations are of great importance. Murray-Darling water, for example, supports 41 percent of the gross value of Australian agricultural production and provides domestic water supplies to such large cities as Canberra and Adelaide.[6] When risks are high and security is threatened, the resource itself may be in peril, as may all of the human activities that rely on the resource.

Maintaining the security of common pool appropriations, however, is a very

[4] Ulrich Beck, *Risk Society - Towards a New Modernity*, trans. Mark Ritter (London: Sage, 1992) 60.
[5] "Carrying capacity" refers to the maximum amount of appropriations that a resource can sustainably support. In this article, the Murray-Darling's carrying capacity is considered to be roughly equivalent to its outflow to the sea, but this is not an authoritative definition. The exact carrying capacity of a resource is usually obscure and varies according to one's preferred priority for the resource.
[6] Murray-Darling Basin Commission, "Basin Statistics."

complex governance task. Two dimensions of complexity are particularly relevant: issues of scale and issues of latency. Scale refers to the geographic area or time period over which a security risk spans and these risks can range from very small-scale issues, such as the access risks in a local irrigation system, to very large-scale issues, such as the supply risks threatened by global warming.[7] Latency simply refers to the recognized prevalence of existing risks: some risks are easily recognizable while others are much less obvious.[8] In many instances, scale and latency are interrelated: risks at larger scales, for example, may remain latent to common pool users fixated on managing only their everyday, small-scale problems.[9] Because risks to common pool security vary in scale and latency, they constitute a continuous and complex challenge to common pool governance. Addressing the recognized risks at any single scale is a difficult governance challenge in itself, but adding the prospect of latent risks and risks at multiple scales serves to complicate the challenges even further. This is some of the uncultivated theoretical ground that common pool theorists are just beginning to work.[10]

Thus far, common pool theorists have made their best contributions by emphasizing the importance of institutions in common pool governance. From a risk management perspective, institutions are a crucial factor in maintaining the security of common pools because it is through institutions that *risk reallocation* takes place. Risk reallocation involves the shifting of risk from one party to another or the spreading of risk across a large number of people. Risk reallocation can enhance security by reducing the overall prevalence of risk and/or by shifting risks to actors who have the resources to better cover them.[11] Institutions are crucial in this process because they serve to 'lock in' a risk reallocation in a common pool for an indefinite period of time. Decisions about risk reallocations are highly contested and, as prevailing risks change, pressures for institutional change are likely to mount.

In the process of risk reallocation, governments are particularly important actors. First, it is the sovereign authority of governments that fundamentally underpins the existence of common pool governance institutions, and it is their "power to compel" that ensures that risk reallocations can be implemented, even if an allocation is contrary to the interests of a few well-positioned users.[12] As Elinor Ostrom has argued, even local, self-organized institutions of common pool governance need to be supported by the state

[7] Martha E. Geores, "The Relationship Between Resource Definitition and Scale: Considering the Forest," *The Commons in the New Millennium - Challenges and Adaptations*, ed. Nives Dolsak & Elinor Ostrom (Cambridge: MIT Press, 2003) 83.
[8] Beck, *Risk Society*.
[9] Geores, "The Relationship Between Resource Definition and Scale" 81.
[10] Oran R. Young, *The Institutional Dimensions of Environmental Change - Fit, Interplay, and Scale* (Cambridge: MIT Press, 2002).
[11] David A. Moss, *When All Else Fails - Government as the Ultimate Risk Manager* (Cambridge: Harvard University Press, 2002) 18.
[12] Moss, *When All Else Fails* 49-50.

if they are to have a reasonable chance at success.[13] Second, governments are generally the only actors who have the resources necessary to cover some of the risks inherent in the appropriation of common pools. Because of the interdependence of common pool users, many of the risks faced by them are what are termed "systematic" or "catastrophic" risks.[14] In short, the users are at risk of a misfortune that could befall many users simultaneously, as would occur in the Murray-Darling during a drought period, for instance. To manage systematic/catastrophic risks, considerable authoritative and monetary resources are often required and these resources are usually beyond the capacity of the at-risk users, either independently or collectively.

Ultimately, from a risk management perspective, the governance of common pools can be analyzed as an infinite dialectic between the recognized risks to user security and the institutions developed to manage these risks. This is not to suggest that users and governments retain perfect knowledge of existing risks, nor to suggest that the institutional responses to recognized risks are automatic or ideal. Political conflicts shape both sides of this dialectic as will become evident in the extended empirical analysis of Murray-Darling water management, presented below. In this case, the recognized risks to water security, and the institutions developed to manage these risks, started out on a small scale and have become progressively larger scale over the past 150 years.

Local Rivalries and the Emergence of Property Rights

From their early efforts at settlement and expansion, the British colonizers of the Australian continent quickly came to recognize water as a crucial and scarce resource in this predominantly arid land. No water system was more important, in this regard, than the Murray-Darling Basin. The largest rivers of the basin served as a crucial transportation link to the interior of the continent, and Murray-Darling water offered the prospect of boundless irrigation and agricultural production to support the growing population. The first area of the Murray-Darling to be appropriated for agricultural production was the River Murray system in the south, predominantly in Victoria. Thus, it is not surprising that Victoria took the lead in developing institutions to enhance farmers' water security in the latter half of the 1800s.

As early as the 1850s, the Australian colonial governments began to explore different philosophies and techniques for enhancing water security in conditions of scarcity. The risks faced by irrigators at this time were predominantly access-related and small-scale. In their view, the Murray was an untouched, unimproved natural resource and irrigators were eager to stake their legal claims to this resource in order to ensure

[13] Elinor Ostrom, *Governing the Commons* (Cambridge: Cambridge University Press, 1990).
[14] Moss, *When All Else Fails* 31.

guaranteed access to water year after year. The resource was in no danger of becoming over-appropriated, but users wanted guarantees from the state in order to secure their appropriations should their access be challenged by other prospective users in the vast melee of frontier settlement. In this way, the irrigators' access risks would be reallocated to the state, and farmers could invest in their farms with a more than reasonable expectation that they would reap the returns.

The colonial governments, particularly in Victoria, recognized the need to enhance the security of Murray appropriations and they studied the issue quite deliberately. In the 1880s, the Victorian government established the Royal Commission on Water Supply whose members traversed the world to investigate many different institutions of water management. Ultimately, the Commission suggested the establishment of government-sanctioned water rights through a system of comprehensive state licensing. This institution was viewed as creating a greater degree of security than the common law riparian rights systems used in most Anglo-American jurisdictions around the world.[15] While the common law systems relied on judicial interpretations of "reasonable use" or "prior appropriations" to protect the security of water rights, state licensing would allow the government greater control of rights allocations.[16] This, it was hoped, would provide a greater degree of security for all water users, but it also put a greater burden on the state than was typical of that time.

Following the recommendations of its royal commission, Victoria adopted a state licensing system in its 1886 *Irrigation Act* and was followed by the other River Murray colonies, New South Wales and South Australia, who had also investigated the issue with royal commissions of their own.[17] Thus, by the time of federation, each state had created its own water use licensing system and was actively allocating water rights among its citizenry. The predominant orientation in this allocation process was toward growth, and, because the Murray was still in the early stages of exploitation, conflicts over supply scarcity were relatively rare and always local in scale.

River-Length Rivalries and Interstate Apportionment

In the late 19th century, a new risk to Murray-Darling water security started to develop in a conflict between the two main uses of the River Murray: irrigation and

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[15] Don I. Wright, "The River Murray: Microcosm of Australian Federal History," *Federalism in Canada and Australia: The Early Years*, ed. Bruce W. Hodgins, D. Wright and W.H. Heck (Waterloo: Wilfred Laurier University Press, 1978) 279-80.

[16] Mark Sproule-Jones, "Property Rights for Water Resources Management (Draft Copy)" (Hamilton, Ontario: Department of Political Science, December 2003).

[17] S.D. Clark & I.A. Renard, "The Riparian Doctrine and Australian Legislation," *Melbourne University Law Review* 7 (September 1970): 475-506.

navigation. Furthermore, this conflict quickly took on a large-scale, inter-colonial face. For New South Wales and Victoria, the Murray was most important as a source of irrigation water and they were busily allocating water rights to encourage growth in agricultural production. As the downstream jurisdiction, however, South Australia viewed the Murray as a vital transportation link with the two senior colonies, and they saw irrigation as a potential threat to the navigability of the Murray.[18] Given the contradictory interests and objectives of these competing uses, water users at both ends of the river felt increasingly at risk. Unlike the small-scale risks associated with securing local water access, though, this was a larger-scale risk that encompassed three colonies. Accordingly, some kind of intergovernmental accord was needed to manage this risk and maintain an acceptable level of water security.

The colonial royal commissions on water management had astutely recognized the potential for inter-colonial water conflicts, and one of the recommendations emerging from their reports was the establishment of some kind of "joint trust" to resolve these conflicts before they could develop into threats to water security[19] }. However, New South Wales' political leaders, such as Sir Henry Parkes, would not consider the establishment of any kind of inter-colonial water management institution because New South Wales benefited greatly from the status quo. As the upstream jurisdiction, New South Wales had first access to much of the water in the basin and they had no interest in limiting their potential for future growth. In fact, in its *Constitution Act* of 1855, New South Wales had been given jurisdiction over the entire course of the Murray and Parkes asserted this jurisdiction, even though the Murray formed much of the Victoria - New South Wales border and extended into the territory of South Australia. Parkes was so adamant about New South Wales' unfettered right to Murray water that "[h]e refused to attend an inter-colonial conference on the issue lest this should seem to involve an admission that the other colonies had an equal right with New South Wales to deal with the [Murray] question".[20] Considering that Victoria appropriated more water from the Murray system at this time than did New South Wales, this was a rather unrealistic position, but it ensured that the brewing interstate conflict over the primacy of irrigation versus navigation would not be addressed for many years.

In the series of conferences that ultimately led to the federation of the Australian colonies in 1900, this conflict resurfaced and the positions of the 'would-be' states had hardened. South Australia, led by J.H. Gordon, fervently argued that the Murray was an indivisible system beyond the competence of any individual state, and that it should be placed under the authority of the new Commonwealth government. New South Wales and Victoria rejected this argument, fearing that federal jurisdiction would threaten their

[18] Don I. Wright, "River Murray - A Continuing Debate," *Journal of the Royal Australian Historical Society* 61.3 (September 1975): 165.
[19] Wright, "The River Murray: Microcosm of Australian Federal History" 279-80.
[20] Wright, "The River Murray: Microcosm of Australian Federal History" 280.

irrigators' security.[21] The resulting division of powers in the Australian Constitution reflects the intractability of this interstate conflict, institutionalizing an unwieldy compromise between the two positions. While the states retained proprietary and regulatory powers over most public waters, these powers were qualified by the general trade and commerce power of the Commonwealth government (s.51(I)) which allowed it to protect the River Murray as transportation route for interstate trade. In turn, this federal power was itself qualified by section 100 which specifically protected irrigation rights from being impaired by the Commonwealth trade and commerce power.[22] In the end, the Australian Constitution merely legitimized the conflicting claims of the states and did little to enhance the security of Murray water.

While the politicians remained deadlocked on institutional reform, the security risks to Murray water users only seemed to grow worse. In the early years of the century, a drought of unprecedented severity hit the basin and resulted in substantially reduced crop yields, particularly in the summer of 1901-02.[23] Farmers began to apply increased pressure on their governments for reforms, an interstate royal commission was formed in 1902, and a series of interstate conferences was held from 1903 to 1914, but no agreement on institutional reform could be reached.[24] Finally, in 1914, the Commonwealth government took the initiative and proposed an institutional arrangement that seemed to satisfy the security concerns of all three states and their major water users. This institution eventually became known as the River Murray Waters Agreement (RMWA) and it resulted in a risk reallocation that introduced a number of new actors into the governance of Murray-Darling water.

Fundamentally, the goal of the RMWA was to substantially increase the states' abilities to maintain security of access for their most important water users, and the risk reallocation in this new institution reflected this. To achieve greater state-based security, the Commonwealth government agreed to cover a larger share of the risk in Murray exploitation than they had covered in the past. The agreement provided for the construction of 26 new locks and weirs along the River Murray, primarily funded by the Commonwealth government.[25] These new diversion works would then be used to manage the implementation of an interstate water apportionment that allocated a defined yearly share of Murray water to each state.[26] A new intergovernmental organization, the

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[21] Wright, "River Murray - A Continuing Debate" 169-70.
[22] Dean Jaensch, *The Politics of Australia*, 2nd ed. (South Yarra: Macmillan Publishers Australia Pty Ltd., 1997); Wright, "River Murray - A Continuing Debate."
[23] Wright, "River Murray - A Continuing Debate" 208.
[24] Wright, "River Murray - A Continuing Debate."; Wright, "The River Murray: Microcosm of Australian Federal History."
[25] K. E. Johnson, "The Role of the River Murray Commission," *The Murray Waters - Man, Nature and a River System*, ed. H.J. Frith and G. Sawer (Sydney: Angus and Robertson, 1974) 284.
[26] The division of Murray water in the RMWA is quite complex and is best described by D.I. Wright

River Murray Commission (RMC), was created to construct and operate the diversion works, but the management of each state's water allocation was left strictly to the state governments.[27]

Essentially, the RMWA dealt with the large-scale security concerns brought on by the rivalry between irrigation and navigation by creating something akin to a state-level property right to Murray water for each of the three Murray states. With their secure shares of Murray water, the states could then ensure the security of their most important water users, whether irrigators or shippers. The risk reallocation in the RMWA was predominantly from smaller scale actors (individual water users and state governments) to larger scale actors (the Commonwealth government and the RMC). The Commonwealth government invested a substantial amount of money in the diversion works on the River Murray, and the RMC was created with the sole purpose of operating these works to guarantee the security of the interstate apportionment. Thus, it seems that the recognition of larger scale risks initiated institutional reforms to involve larger-scale actors in the governance of the Murray, though the achievement of these reforms was an onerous political process spanning a number of decades.

Irrigation and Salinity in the Murray System

For many years, the RMWA proved to be an effective institution for the states, helping them to maintain security for their most important Murray water users. The community of users, however, eventually underwent a slow but significant transformation. As land-based and air-based transportation networks improved in Australia, the importance of the River Murray as a commercial transportation link sharply declined. At the same time, irrigation uses of Murray water continued to grow in all states and gradually displaced navigation as the most important use in South Australia. New types of water users also started to appear on the scene, such as domestic and recreational users from urban areas, but these groups remained marginal in comparison to

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(1975, p. 175): "The flow of the Murray at Albury (including the natural or regulated flow of all tributaries above Albury was to be shared equally by New South Wales and Victoria (subject to deductions for water diverted by either State above Albury). Each of these States was to have full use of its own tributaries below Albury. South Australia was allocated a monthly provision for domestic and stock use, losses by evaporation in Lake Victoria and in lockage (but not in the lakes at the mouth), and 67,000 acre feet per month for nine months for irrigation – a total of 1,254,000 acre feet [per year] in all. After this had been supplied to South Australia, 1,957,000 acre feet to New South Wales and 2,219,000 acre feet to Victoria; the RMC could allocate any surplus as it saw fit."

[27] The RMC was composed of two commissioners from each of the state governments (usually senior water administrators) and two from the Commonwealth government (usually federal Cabinet ministers) and it was supported by a small secretariat. Its mandate was simply to administer the River Murray diversion works in order to meet the interstate apportionment on a yearly basis. See Johnson (1974) and Clark (1983) for an extended description of RMC.

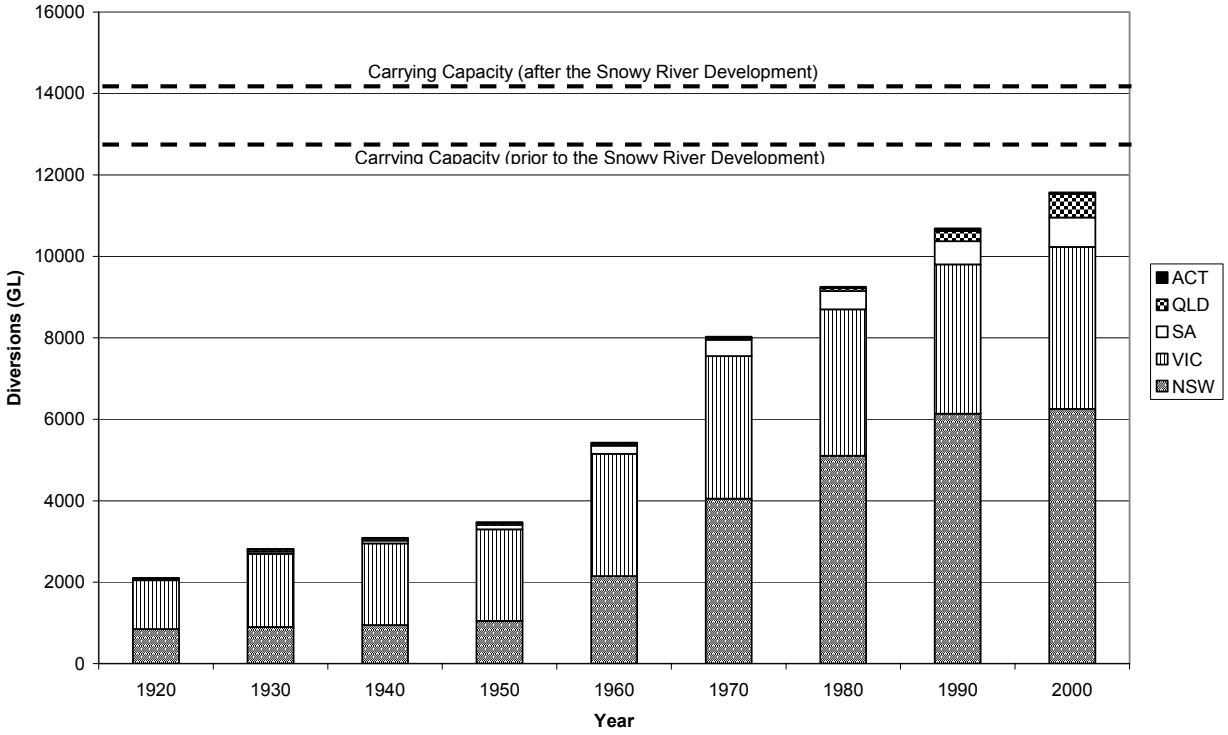
the irrigators. The predominant focus of Murray water use was irrigation and the RMWA proved successful in allowing the states to maintain water security for their growing ranks of irrigators.

Irrigation along the Murray and its tributaries increased so rapidly that, by the 1960s, new risks were recognized as once again challenging the security of Murray water. From 1920 to 1960, the amount of water appropriated from the Murray-Darling Basin more than doubled, from approximately 2,000 GL to over 5,000 GL, and most of these appropriations took place in the Murray system, as much of the Darling system still remained in the early stages of irrigation development (see Figure 1, below). As the level of water appropriations grew, so did the recognition of two new large-scale risks. The first risk was related to the finite quantity of water available along the Murray and the fear that its carrying capacity might soon be reached. The second risk was increased water salinity, an unintended by-product of irrigation that was reducing the Murray's carrying capacity below its natural level..[28] Combined, these two risks constituted a recognized security threat to Murray water, but, once again, there was interstate discord on the severity of the risks and the measures needed to ensure water security.

As in many Murray-Darling governance issues, interstate disagreement in the 1950s and 1960s was split on an upstream-downstream basis. New South Wales and Victoria, where most irrigation was taking place, were much less at risk than South Australia because they had the first opportunity to appropriate Murray water and could then send the saline by-product downstream to their South Australian neighbours. South Australia, for its part, watched salinity levels in the lower Murray rise continuously and began to fear for the security of its state allocation: their share of Murray water was no good to them if it was too saline for agricultural or domestic use. Though there were calls from the South Australians for upstream restraint in water use, these were not taken seriously by New South Wales and Victoria. There was, however, one point on which all states could agree.

[28] P.G. Cooper, "River Murray Water Management in South Australia," *Who Owns the Murray? A South Australian Perspective*, ed. Peter S. Davis and Phillip J. Moore (Magill: River Publications, 1985) 98-123.

Figure 1: Appropriations in the Murray-Darling Basin Since 1920



Looking at the approximate level of water appropriations in the Murray-Darling in 1950, it is apparent that less than one quarter of the Murray-Darling's possible carrying capacity was being appropriated at that point. However, to gain access to the other three quarters of the basin's carrying capacity, extensive diversion works and storages would have to be constructed in order to capture as much water as possible and to make it available when and where it was needed. Increasing the accessible supply of Murray-Darling water, despite the costs involved, was a benefit to all states: New South Wales and Victoria could continue to encourage irrigation growth and South Australia could enjoy greater security in its state allocation. Thus, the Murray states and the Commonwealth government embarked on a spate of dam and storage construction that was without precedent. The total water storage capacity in the Murray-Darling was increased from approximately 5,000 GL in 1950 to approximately 30,000 GL by 1980, more than twice the natural carrying capacity of the entire basin.[29] Even the basin's carrying capacity itself was increased through dam construction. The Snowy River development diverted a number of rivers from the Southeast Coast basin into the Murray

[29] Murray-Darling Basin Commission, "Water Use," 2001, http://www.mdbc.gov.au/education/encyclopedia/Water_Use/Water_Use.htm (4 December 2001).

system, adding an extra 2,000 GL of water to the Murray-Darling Basin.[30] Over the course of four decades, the Murray became one of the most intensely regulated rivers in the world.

To deal with the large-scale risks of increased irrigation and increased salinity, and to manage the massive diversion works constructed to mitigate these risks, a number of institutional reforms also took place. Though the basic features of the RMWA were not renegotiated, piecemeal amendments to the RMWA were undertaken on seven different occasions between 1914 and 1963.[31] The RMC was given an expanded mandate to investigate salinity issues and to operate diversion structures to create dilution flows to manage salinity.[32] With more diversion works under its authority and an expanded mandate, the RMC gradually grew in influence in the governance of Murray-Darling water, particularly from the 1960s onward. As in the past, the Commonwealth was a crucial source of funding for the construction of dams and storages, particularly for large works that would have interstate effects. Yet, despite the increased importance of the RMC and the Commonwealth, the states remained the authoritative regulators of water usage during this period.

Overall, the recognition of large-scale risks associated with increased irrigation and salinity resulted in a risk reallocation that once again increased the prominence of large-scale actors in Murray-Darling water governance. This was particularly true of the RMC, now charged with a greater share of risk management in the basin, though the widespread construction of large diversion works would not have been possible without Commonwealth participation. Nevertheless, the preponderance of risk management responsibility remained with the states as they still used their interstate allocations to ensure the security of their users' individual property rights. The institutional reforms creating this modest risk reallocation were incremental, and lagging well behind the recognition of potential risks, but the correlation between the recognition of large-scale risks and the empowerment of large-scale actors is still quite evident.

Basin-wide Risks, Basin-wide Solutions

While the massive dam and storage projects constructed from the 1950s through the 1970s increased the security of existing users in the Murray-Darling Basin, they also created opportunities for further exploitation. The accessible supply of water was increased and this supply could now be manipulated to provide access for a greater number of users through the effective timing of storage releases. As well, some of the

[30] Lionel Wigmore, *Struggle for the Snowy* (Melbourne: Oxford University Press, 1968).
[31] Amendments to the RMWA were made in 1923, 1934, 1948, 1950, 1954, 1958 and 1963.
[32] Johnson, "The Role of the River Murray Commission" 160.

more marginal and remote parts of the basin, in New South Wales and Queensland, were being put into agricultural production and water usage in these areas was skyrocketing. In sum, the level of water appropriations continued to increase across the basin throughout the 1970s and 1980s and many of the state governments were complicit in this increase (see Figure 1, above). Accordingly, the salinity problem persisted, as did concerns that the carrying capacity of the basin might soon be exceeded. In both of these matters it was the RMC and the Government of South Australia who were most vocal in their risk warnings.

During this period, a number of crises occurred that gradually convinced most authorities in the basin that a significant supply risk was emerging. The first crisis was a contentious conflict between New South Wales and South Australia over the expansion of irrigation in the Darling system. From 1979 to 1981, the South Australian government tried unsuccessfully to intervene in the domestic politics of New South Wales to prevent the issuance of new irrigation licenses in the Darling area, fearing for the security of its Darling water flows.[33] On the heels of this crisis, a drought period occurred in the early 1980s, placing the security of most water appropriations in the basin at jeopardy for a time. Finally, in 1991, water quality in the Darling deteriorated to such a degree that a 1,000 km long bloom of toxic blue-green algae developed, killing large numbers of fish and livestock, and rendering the water unfit for any use for a number of weeks.[34] Combined, these crises suggested the presence of latent risk in the Murray-Darling water supply, but the traditional solution of new dam construction was no longer sufficient to address this risk.

By the late 1980s, total appropriations in the basin were approaching the basin carrying capacity and no amount of dam construction could forestall this. Furthermore, the total level of appropriations allowed by state permits had grown to around 16,900 GL, *over 2,500 GL in excess of the basin's carrying capacity*.[35] If every user entitled to Murray-Darling water actually took their legally protected shares, the resource would be destroyed.[36] This presented a risk unlike any in the past. Governments and users were now confronted with the imperative of making zero sum choices in the governance of Murray-Darling water, an unpleasant task they had put off for decades through dam and storage construction. As well, the risk now confronting them was catastrophic/systematic in nature, affecting all users and all governments in the basin, and existing at the largest

[33] Kim Alvarez, Personal Interview (7 August 2002); Sanford D. Clark, "Inter-Governmental Quangos: The River Murray Commission," *Quangos - The Australian Experience*, ed. G.R. Curnow and C.A. Saunders (Sydney: Hale & Iremonger, 1983) 123-24.
[34] Andy Close, Personal Interview (11 July 2002).
[35] *Murray-Darling Basin Ministerial Council*, *An Audit of Water Use in the Murray-Darling Basin*8 (1995)
[36] Not every state-permitted water allocation is fully utilized due to the persistence of 'sleeper' and 'dozer' rights. Sleepers are those water rights that have not yet been utilized and dozers are those rights that are only being partially utilized.

scale possible. The relatively weak, Murray-centric intergovernmental institutions of the RMWA were entirely inadequate to deal with risks of this scale and magnitude, so institutional reform once again proved necessary.

Though South Australia began calls for the renegotiation of the RMWA as early as the 1960s, New South Wales and Victoria ignored or resisted these calls, enjoying the security of their upstream location and their shares of the interstate water apportionment. According to the upstream states, any restraint of water appropriations should take place on an intra-state basis, within the framework of the RMWA. The interstate institutions might require some minor adjustment, but no fundamental reform was needed. Thus, the institutional reform process of this period took place in a two-track manner, the faster track within the states and slower track between them.

In general, intra-state institutional reforms took place as the states individually confronted the limits of their respective allocations of Murray water. South Australia was the first to recognize this in 1967 and it introduced a moratorium on the issuance of new licenses and the extension of existing licenses for the Murray.[37] Similar limits were then introduced in various parts of the basin in New South Wales and Victoria, starting in the mid 1970s.[38] In this way, the states endeavoured to address the large-scale supply risks of the Murray-Darling in a small-scale manner, but these efforts proved ineffective in enhancing water security and, by the early 1980s, most political actors in the basin recognized a need for institutional development at a larger scale.

Particularly after the drought of 1982-83, the upstream states began to reconsider the utility of the RMWA in addressing the large-scale supply risks facing them. In 1985, the Government of Victoria joined with the Government of South Australia in endorsing an institutional reform agenda put forward by the RMC, and a series of high-level intergovernmental meetings on institutional reform was subsequently held between 1985 and 1987. With the Victorian and Commonwealth representatives brokering the conflicting positions of South Australia and New South Wales, and the fortuitous existence of Labor governments in all four jurisdictions, agreement was reached in 1986 on the creation of a permanent ministerial council to coordinate the governance of the basin.[39] In turn, the ministerial council then successfully negotiated the Murray-Darling Basin Agreement (MDBA) of 1987, intended as the successor institution to the RMWA. The new agreement was ratified in 1992 and Queensland and the ACT joined as formal participants in 1996 and 1998, respectively.[40]

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[37] Cooper, "River Murray Water Management in South Australia" 104-07.
[38] Alvarez, Personal Interview; Campbell Fitzpatrick, Personal Interview (23 July 2002).
[39] Peter Crabb, "Managing Water Resources in Interstate River Basins," *Comparative Political Studies - Australia and Canada*, ed. Malcolm Alexander and Brian Galligan (Sydney: Longman Cheshire Pty Limited, 1992) 198.
[40] Murray-Darling Basin Commission, "The Murray-Darling Basin Initiative - Overview," About the

The MDBA represented a substantial institutional break from the past because it institutionalized a risk reallocation in which intergovernmental actors were given very significant risk management responsibilities, in conjunction with the risk management responsibilities retained by the states. Under the agreement, basin-wide governance decisions for the Murray-Darling are undertaken on an intergovernmental basis within the Murray-Darling Basin Commission and the Murray-Darling Basin Ministerial Council, the Commission dealing with technical and administrative matters and the Ministerial Council dealing with policy matters.[41] While the decisions of these forums are not legally-binding on the states, they do possess a considerable degree of political legitimacy. This legitimacy derives from the consensual nature of Commission and Ministerial Council decision-making as well as from the work of various influential intergovernmental actors, such as the Commission Office,[42] who work tirelessly to support their implementation. In this way, the intra-state management efforts of the state governments work in tandem with the basin-wide management efforts of the MDBA institutions, and risk is distributed widely among the authorities involved in Murray-Darling governance. Furthermore, viable institutions now exist at both the largest and smallest scales of water governance, enabling the recognition and management of risks at all scales.

One of the best examples of the way in which the MDBA has transformed water governance in the Murray-Darling was the creation of the Cap on Diversions in 1995. The notion of a basin-wide, cumulative limit on appropriations was first brought forward in the Ministerial Council by a South Australian representative in 1993.[43] The matter was referred to the Commission Office for study, and the Office produced a landmark report, "An Audit of Water Use in the Murray-Darling Basin," which outlined in stark terms the impending risk of over-appropriation in the basin and the existing reality of over-allocation in the state permitting systems.[44] In response to this report, the Ministerial Council, in June 1995, established the Cap on Diversions which determined to limit cumulative appropriations in the basin to those corresponding with 1993-94 levels of development.[45] A new intergovernmental institution comprised of non-partisan water

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Initiative, 2001, http://www.mdbc.gov.au/about/governance/overview.htm (3 December 2001).

[41] The Murray-Darling Basin Commission is comprised of senior administrators in land and water management from the MDBA's member governments, while the Murray-Darling Basin Ministerial Council is comprised of all the ministers responsible for land and water management in the MDBA's member governments.

[42] The Commission Office is an intergovernmental administrative organization that supports the Murray-Darling Basin Commission and the Murray-Darling Basin Ministerial Council. It is located in Canberra but is not a Commonwealth agency. Its budget costs are shared by the MDBA member governments.

[43] *John Klunder*, *Cong.*, *The Changing Demands for Surface Water in the Murray-Darling Basin* (, 25 Juned Sess.Speech 1993)

[44] Murray-Darling Basin Ministerial Council, *An Audit of Water Use in the Murray-Darling Basin*.

[45] The Cap on Diversions was formalized as Schedule F of the MDBA and its operation deserves some

experts, the Independent Audit Group, was then created to facilitate the setting of Cap levels for each state and to oversee compliance with the Cap through yearly monitoring.[46] Though some conflicts about Cap definitions and Cap compliance still persist in parts of Queensland, New South Wales and the ACT, most would agree that the Cap has improved the security of appropriations in most parts of the basin, the fundamental goal of its creation.[47]

What is most distinct about the MDBA compared to past institutions is its capacity for proactive large-scale risk management through intergovernmental processes. Actors such as the Commission Office and the Independent Audit Group monitor and advise on large-scale risks, while decisions on large-scale risk management are made within the Commission and Ministerial Council. This is much different than the mandate of the RMC, which was designed to manage a specifically recognized risk, the interstate apportionment, and which lacked the "political coverage" of a ministerial council to deal with other recognized risks.[48] Accordingly, while the RMWA proved inadequate in addressing emerging large-scale risks, the MDBA's track record is more impressive: the Cap is addressing the threat of large-scale over-appropriation; the Salinity Management Strategy is addressing the threat of large-scale salinization; and, the Environmental Flows Initiative is addressing the threat of large-scale degradation to the riverine environment.[49] This is not to suggest that all of these efforts are unmitigated successes, but the capacity for proactive large-scale risk management in the Murray-Darling is much greater now than at any time in the past.

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elaboration. Neither the MDBA nor the Cap eliminated the interstate apportionment; the apportionment of Murray water still continues and is administered by River Murray Water, an independent sub-section of the Commission Office. While the apportionment represents the *minimum* amount of water a state can expect to appropriate in any given year, the Cap represents the *maximum* amount of water a state should appropriate in any given year. Under the Cap, this maximum level for any given year is set according to "…the volume of water that would have been used with the infrastructure (pumps, dams, channels, areas developed for irrigation, etc.) and management rules that existed in 1993/94, assuming similar climatic and hydrologic conditions to those experienced in the year in question." Essentially, this means that Cap levels will vary from year-to-year, being higher in wet years and lower in dry years, with level of development held constant. Development beyond 1993/94 levels is permitted, but can only be undertaken through water savings from existing appropriations. (Quote is taken from: Independent Audit Group, *Setting the Cap – Report of the Independent Audit Group*. (Canberra: Murray-Darling Basin Commission, 1996)).

[46] Independent Audit Group, *Setting the Cap - Report of the Independent Audit Group*, Murray-Darling Basin Ministerial Council (Canberra: Murray-Darling Basin Commission, 1996).

[47] Independent Audit Group, *Review of Cap Implementation 1999/00* (Canberra: Murray-Darling Basin Commission, 2001); Independent Audit Group, *Review of Cap Implementation 2000/01* (Canberra: Murray-Darling Basin Commission, 2002).

[48] Commonwealth Commissioner, Personal Interview (16 July 2002).

[49] The Salinity Management Strategy seeks to limit overall salinity in the basin through valley-by-valley salinity targets and the Environmental Flows Initiative seeks to restore riverine environments along the Murray by lowering the Cap and allocating this water to environmental uses. Like the Cap, both are large-scale risk management efforts and both are new since the introduction of the MDBA. (For more information, consult the Murray-Darling Basin Commission's excellent website: www.mdbc.gov.au).

Conclusions

While the number of generalizable conclusions from a single case study is necessarily limited, this examination of water governance in the Murray-Darling Basin does suggest a number of avenues for further research and theory building in the study of common pools. At the very least, it suggests that common pool governance can be usefully studied from a risk management perspective, and this sort of approach may be useful in filling some of the holes of mainstream common pool governance theory.

Thus far, most of the theory-building in mainstream common pool analysis has focused on questions of institutional design to the detriment of questions focused on institutional formation and change. This is a critical weakness given the obvious link between institutional design and institutional change. The risk management analysis in this paper suggests that common pool governance institutions are formed and reformed in response to changing patterns of risk. In the case of the Murray-Darling, a transboundary common pool, the risks confronting the resource were increasingly large in scale, so the institutions developed to manage these risks also became increasingly large in scale. However, this relationship between risks and institutions is not direct or immediate: the recognition of risks and the reform of institutions are both contentious political processes. Recall, for instance, the repeated reluctance of the upstream states to recognize the security risks claimed by the South Australians and the extended periods of intergovernmental negotiation, sometimes stretching over decades, that preceded most instances of institutional reform. Because of such political contention, many water governance institutions in the basin became outdated, incapable of addressing new risks because of their antiquated design. This highlights the link between institutional design and institutional change and it suggests that common pool governance institutions need to be adaptable to emerging risks, a notion already gaining recognition in common pool theory, and that common pool theorists need to focus more attention on factors that affect institutional adaptability such as vested interests and path dependency.[50]

Risk management analyses may also contribute to some of the emerging theoretical questions of common pool governance relating to scale and multi-level governance. It is now widely recognized by common pool theorists that common pool governance is multi-scalar, taking place at multiple levels of governance. Yet, most studies of common pool governance have focussed on a single scale, whether it is the local, regional, national, international or global. Developing an approach that embraces the empirical complexity of multi-level governance but also facilitates general theory

[50] Thomas Dietz, Elinor Ostrom, and Paul C. Stern, "The Struggle to Govern the Commons," *Science* 302 (12 December 2003): 1909.

development is a very difficult task. The concepts of risk and security may be useful, in this regard, because they are empirically relevant, they exist at all scales and they are nested between these scales. This clearly facilitates a multi-level approach to analyzing common pool institutions, and may yield important new insights into institutional design. For example, the proactive risk management capacity of the MDBA clearly differentiates it from the more narrow and reactive risk management capacity of the RMWA, and the design of the MDBA may serve as an effective institutional design model for other transboundary common pools confronted with large-scale security risks. However, more comparative analyses between transboundary cases need to be undertaken in order to claim this definitively.

Perhaps the most definitive conclusion from this study is the existence of a "double vulnerability" in the governance of transboundary common pools. Given their size, transboundary common pools are vulnerable to large-scale security risks, and these risks may remain unrecognized for an extended period of time because of the fragmentation of governance authority among multiple sovereign jurisdictions. Compounding this vulnerability is the protracted difficulty of institutional reform through intergovernmental negotiations and the general reluctance of sovereign governments to cede significant governance authority to intergovernmental institutions where large-scale risks can be more effectively managed. Thus, transboundary common pools seem particularly vulnerable in terms of both risk recognition and institutional adaptation, making them much less secure than their formidable sizes would suggest.

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